Arthropoda Selecta 19(3): 129–143

New or poorly-known millipedes (Diplopoda) from Papua New Guinea, 2

Новые и малоизвестные двупарноногие многоножки (Diplopoda) из Папуа — Новой Гвинеи. 2

S.I. Golovatch[1], P. Stoev[2] & D. VandenSpiegel[3]
С.И. Головач[1] , П. Стоев[2], Д. ВанденШпигель[3]

[1] Институт проблем экологии и эволюции РАН, Ленинский проспект, 33, Москва 117071 Россия.

[1] Institute for Problems of Ecology and Evolution, Russian Academy of Sciences, Leninsky pr. 33, Moscow 119071 Russia.

[2] National Museum of Natural History, Bulgarian Academy of Sciences, Blvd Tsar Osvoboditel 1, Sofia 1000 Bulgaria.

[2] Национален природонаучен музей БАН, бул. Цар Освободител 1, София 1000 България

[3] Musée Royal de l'Afrique centrale, B-3080 Tervuren, Belgium.

KEY WORDS: Diplopoda, Pyrgodesmidae, Cryptodesmidae, Opisotretidae, taxonomy, new species, Papua New Guinea.

КЛЮЧЕВЫЕ СЛОВА: Diplopoda, Pyrgodesmidae, Cryptodesmidae, Opisotretidae, таксономия, новый вид, Папуа – Новая Гвинея.

ABSTRACT. Two new species of Diplopoda are described from Papua New Guinea: *Evurodesmus proximus* sp.n. (Pyrgodesmidae) and *Astrolabius hoffmani* sp.n. (Cryptodesmidae), their respective genera being refined and re-diagnosed. *Solaenaulus butteli* (Carl, 1922) (Opisotretidae) has been found for the first time beyond its type locality in Sumatra, Indonesia, being also redescribed in due detail, based on material from Papua New Guinea. *S. birmanicus* Carl, 1941, formerly treated as a subspecies of *S. butteli*, is considered as a full species, stat.n.

РЕЗЮМЕ. Из Папуа – Новой Гвинеи описаны два новых вида диплопод: *Evurodesmus proximus* sp.n. (Pyrgodesmidae) и *Astrolabius hoffmani* sp.n. (Cryptodesmidae), а диагнозы их соответствующие родов уточнены и даны заново. Вид *Solaenaulus butteli* (Carl, 1922) (Opisotretidae) впервые найден за пределами своего типового локалитета на Суматре (Индонезия) и тщательно переописан по пробе из Папуа – Новой Гвинеи, а *S. birmanicus* Carl, 1941, считавшийся прежде подвидом *S. butteli,* повышен в статусе до полного вида, stat.n.

Introduction

The present contribution continues our efforts in identifying at least certain parts of the outstanding collection of Diplopoda taken in 1975 in Papua New Guinea by Petar Beron, of the National Museum of Natural History in Sofia, Bulgaria (NMNHS) [Golovatch & Stoev, 2009]. Here we focus on three species in three families of Polydesmida, two of the species being new, while the third representing the first formal record beyond the type locality in Sumatra, Indonesia.

Most of the material treated hereafter has been housed in NMNHS, with only a few duplicates donated to the Zoological Museum, State University of Moscow, Moscow, Russia (ZMUM) and Danish Museum of Natural History, Copenhagen, Denmark (ZMUC), as indicated below. SEM micrographs were taken using a JEOL JSM-6480LV scanning electron microscope. SEM material was coated with gold and, after examination, it was removed from stubs and returned to alcohol.

Taxonomy

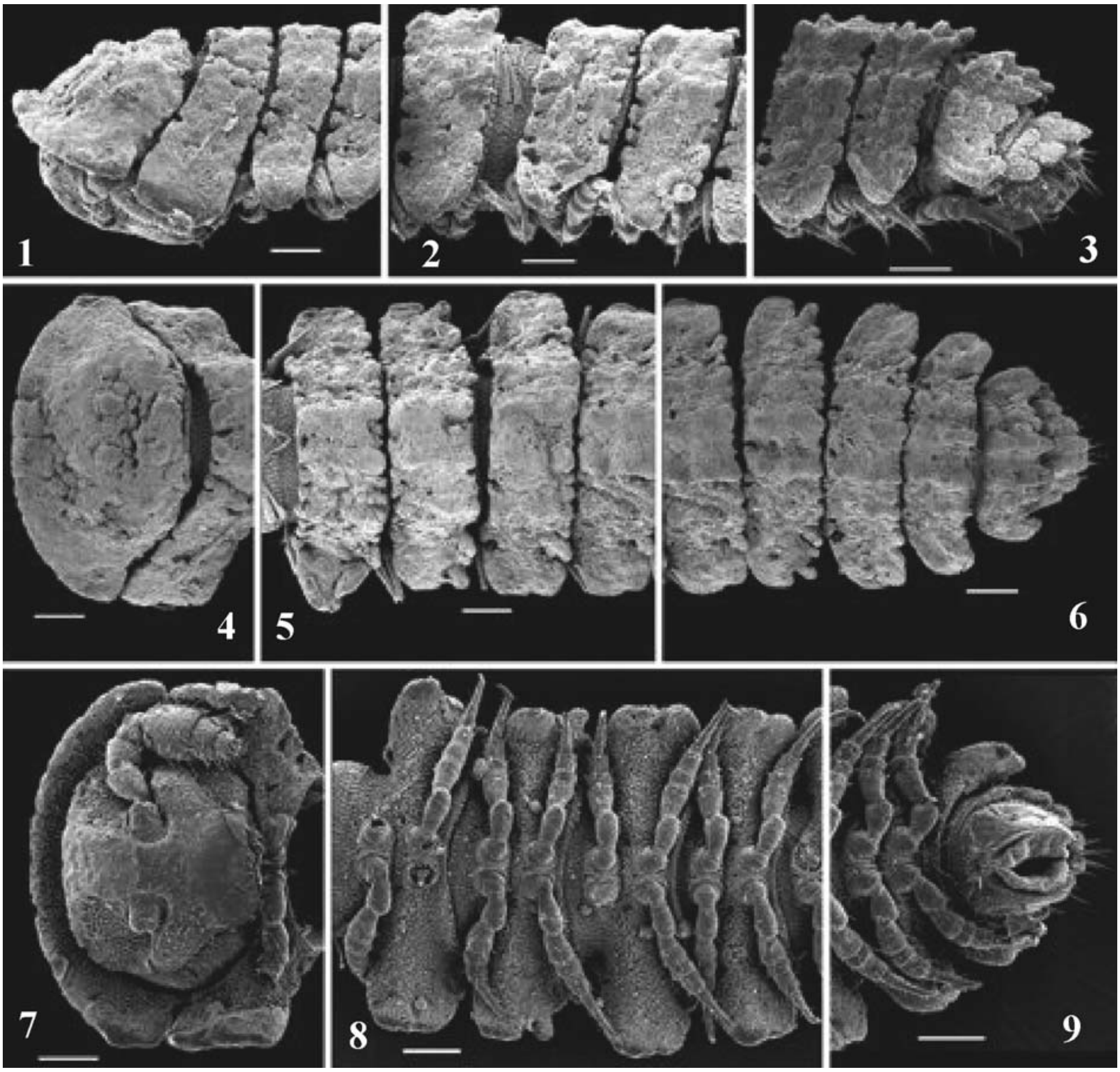
Pyrgodesmidae

Evurodesmus proximus **sp.n.**
Figs 1–24.

HOLOTYPE ♂ (NMNHS), Papua New Guinea: Chimbu Province, Goglme Village, Cave Ogon I, 1975, leg. P. Beron.

PARATYPES, same locality, data and collector: 2 ♂♂ fragm., 1 ♂ SEM, 3 ♀♀, 10 juv., 2 fragm. (NMNHS); 1 fragm. ♂, 1 ♀ (ZMUM), 1 ♀, 1 juv. ♀ (ZMUC).

DIAGNOSIS. Differs from the only hitherto known congener, the type species *E. biroi* Silvestri, 1920, also from Papua New Guinea [Silvestri, 1920], in a different number of body segments in the ♂ (19 vs 20); in a slightly different ozopore formula (5, 7, 9, 12 and 15, all borne on porosteles, vs 5, 7, 9, 10, 12, 13, 15–19, of which 5, 7, 9, 10, 12, 13, 15 and 16 are borne on porosteles); by a less strongly lobulated front margin of the collum; by bi-, not trilobate, paraterga 17, and in the gonopods considerably more elongate and slender.



Figs 1–9. *Evurodesmus proximus* sp.n., ♂ paratype: 1, 4 & 7 — anterior part of body, lateral, dorsal and ventral views, respectively; 2, 5 & 8 — middle part of body, lateral, dorsal and ventral views, respectively; 3, 6 & 9 — posterior part of body, lateral, dorsal and ventral views, respectively. Scale bars: 0.1 mm.

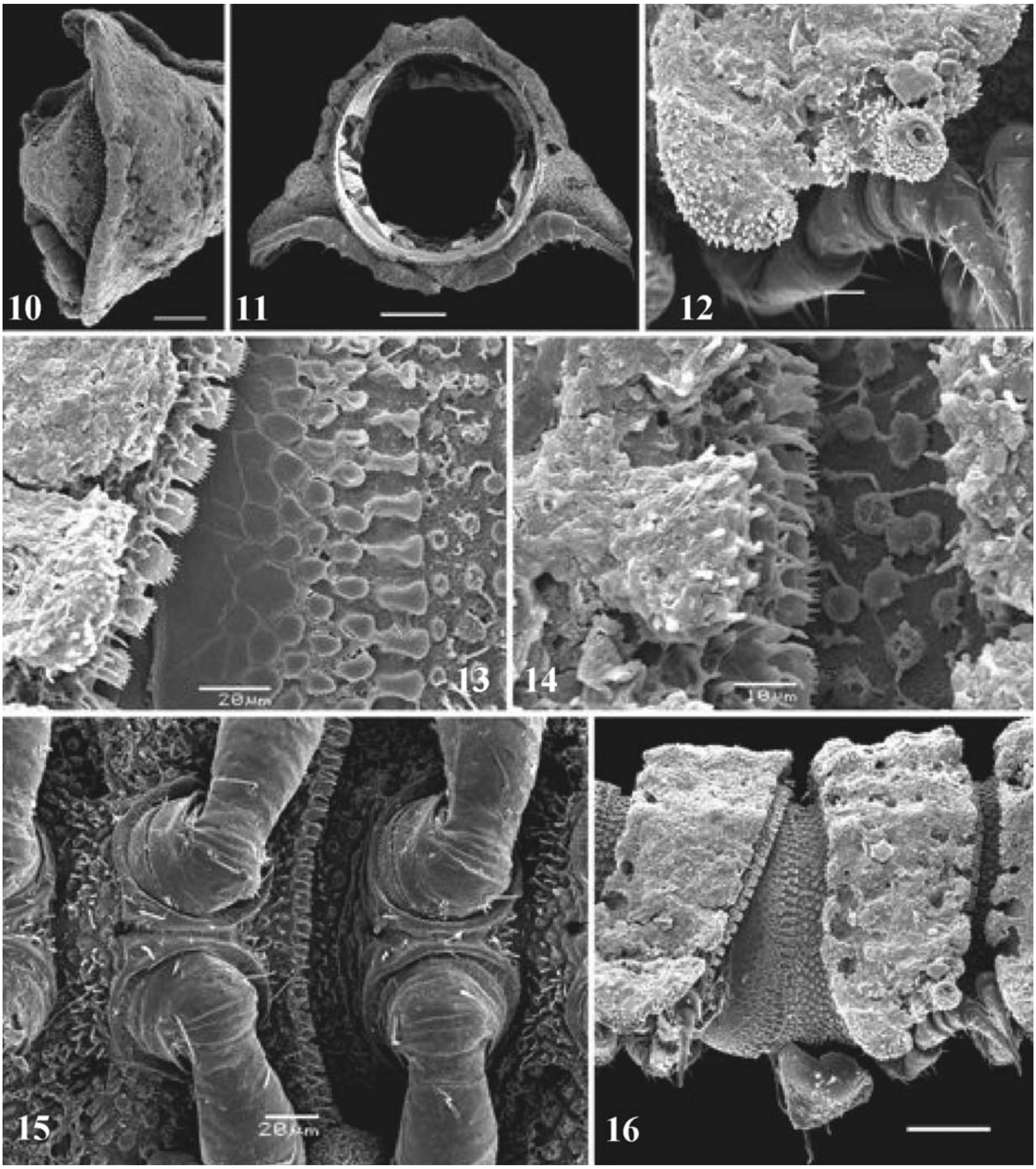
Рис. 1–9. *Evurodesmus proximus* sp.n., паратип ♂: 1, 4 и 7 — передняя часть тела, соответственно сбоку, сверху и снизу; 2, 5 и 8 — средняя часть тела, соответственно сбоку, сверху и снизу; 3, 6 и 9 — задняя часть тела, соответственно сбоку, сверху и снизу. Масштаб: 0,1 мм.

NAME. To reflect the proximity, both morphological and geographic, to *E. biroi*, the only known congener.

DESCRIPTION. Length ca 4.0 mm (♂) to 5.0 mm (♀), width of midbody segments 0.45 (♂) to 0.55 (♀) on prozona, 0.7 (♂) to 0.8 mm (♀) on metazona, respectively.

Coloration from rather uniformly light grey-brown to metazona dark grey-brown with contrastingly pallid legs, venter, antennomeres 1–3 and clypeolabral region of head. Prozona and antennomeres 5–7 light brown to pallid. Vertigial region of head marbled brown to grey.

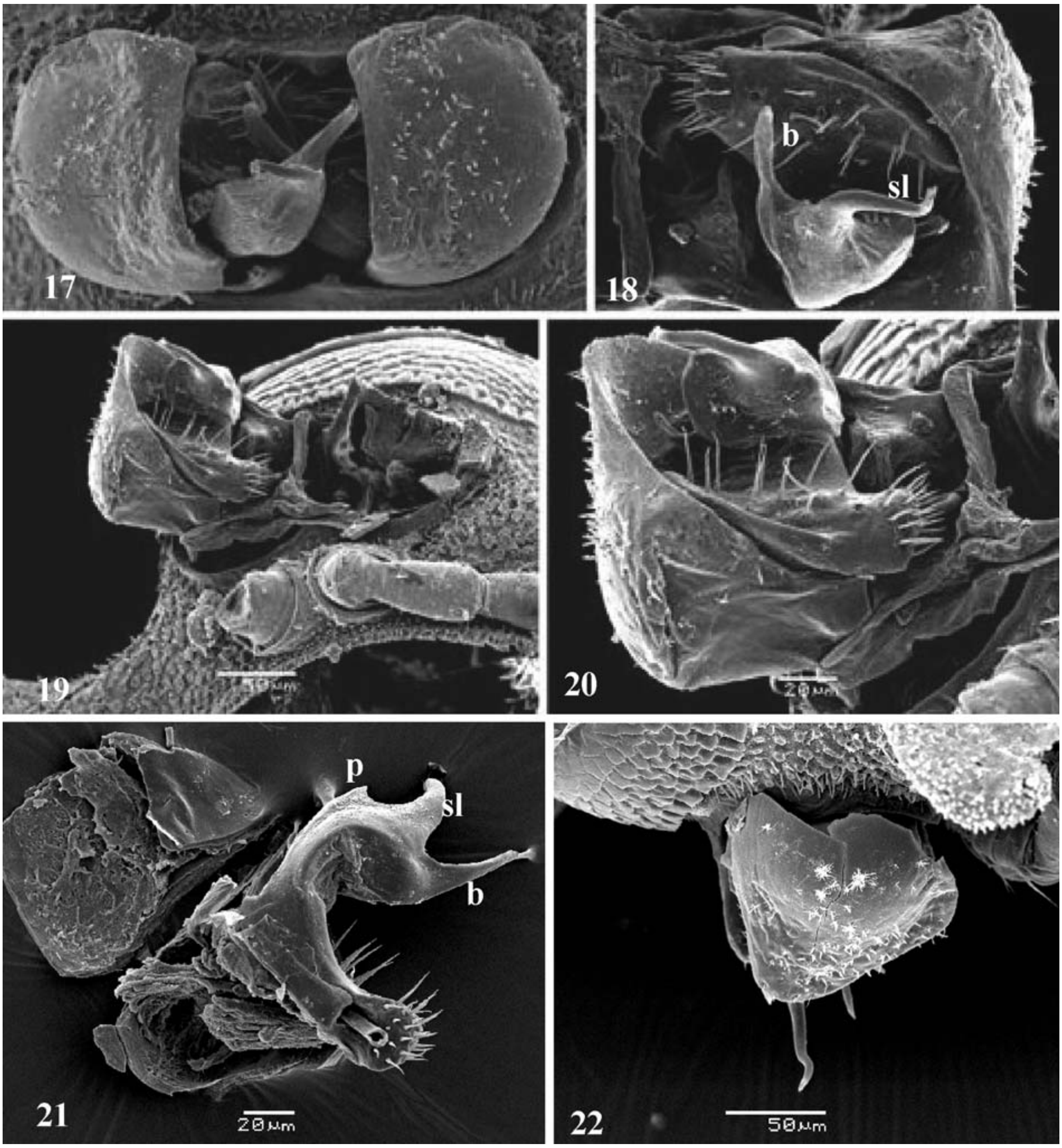
Body robust, with 19 (♂) or 20 (♀) segments. Body width: collum > segment 2 > 3–16 (♂) or 4–17 (♀), thereafter body rapidly tapering towards telson. Head transverse (Figs 7 & 10), densely setose in clypeolabral region, roughly granulate above antennal sockets. Interantennal isthmus slightly larger than antennomere 1. Antennomere 5 largest. Collum (Figs 1, 4, 7 & 10) covering head from above, fore margin with 5+5 indistinct, slightly upturned lobulations, middle part with 1+1, rear one-third with 2+2, faint, rounded tuberculations among abundant microgranulations. Paraterga low, reaching level of venter (Figs 1–3, 11 & 16). Dorsum strongly convex (Fig. 11), paraterga only slightly turned



Figs 10–16. *Evurodesmus proximus* sp.n., ♂ paratype: 10 — head and collum, frontodorsal view; 11 — cross-section of a midbody segment, posterior view; 12 — midbody poriferous paratergum, lateral view; 13 & 14 — texture of posterior halves of metazona with limbus and of anterior halves of prozona, dorsal view; 15 — sternal region, ventral view; 16 — segments 6 & 7, lateral view. Scale bars: 0.1 (10, 11 & 16), 0.05 (12), 0.02 (13 & 15) and 0.01 mm (14).

Рис. 10–16. *Evurodesmus proximus* sp.n., паратип ♂: 10 — голова и коллум, вид спереди и сверху; 11 — поперечный срез среднетуловищного сегмента, вид сзади; 12 — среднетуловищный паратергит с озопорой, вид сбоку; 13 и 14 — текстура задних половин метазонитов с лимбусом и передних половин прозонитов, вид сверху; 15 — стернальный район, вид снизу; 16 — сегменты 6 и 7, вид сбоку. Масштаб: 0,1 (10, 11 и 16), 0,05 (12), 0,02 (13 и 15) и 0,01 мм (14).

subhorizontally, almost continuing outline of dorsum. Tegument often strongly encrusted with cerotegument, dull (Figs 1–6). Prozona very delicately alveolate (Figs 13, 14 & 16). Metaterga with modestly differentiated tuberculations in usual three transverse rows (Figs 1–3, 5, 6 & 16); starting from midline, longitudinal rows 2 and 5 evidently enlarged compared to others. Paraterga rather indistinctly lobulated laterally (Figs 1–9 & 16), with three lobulations on segment 2, with two lobulations on following poreless segments, with one anterior

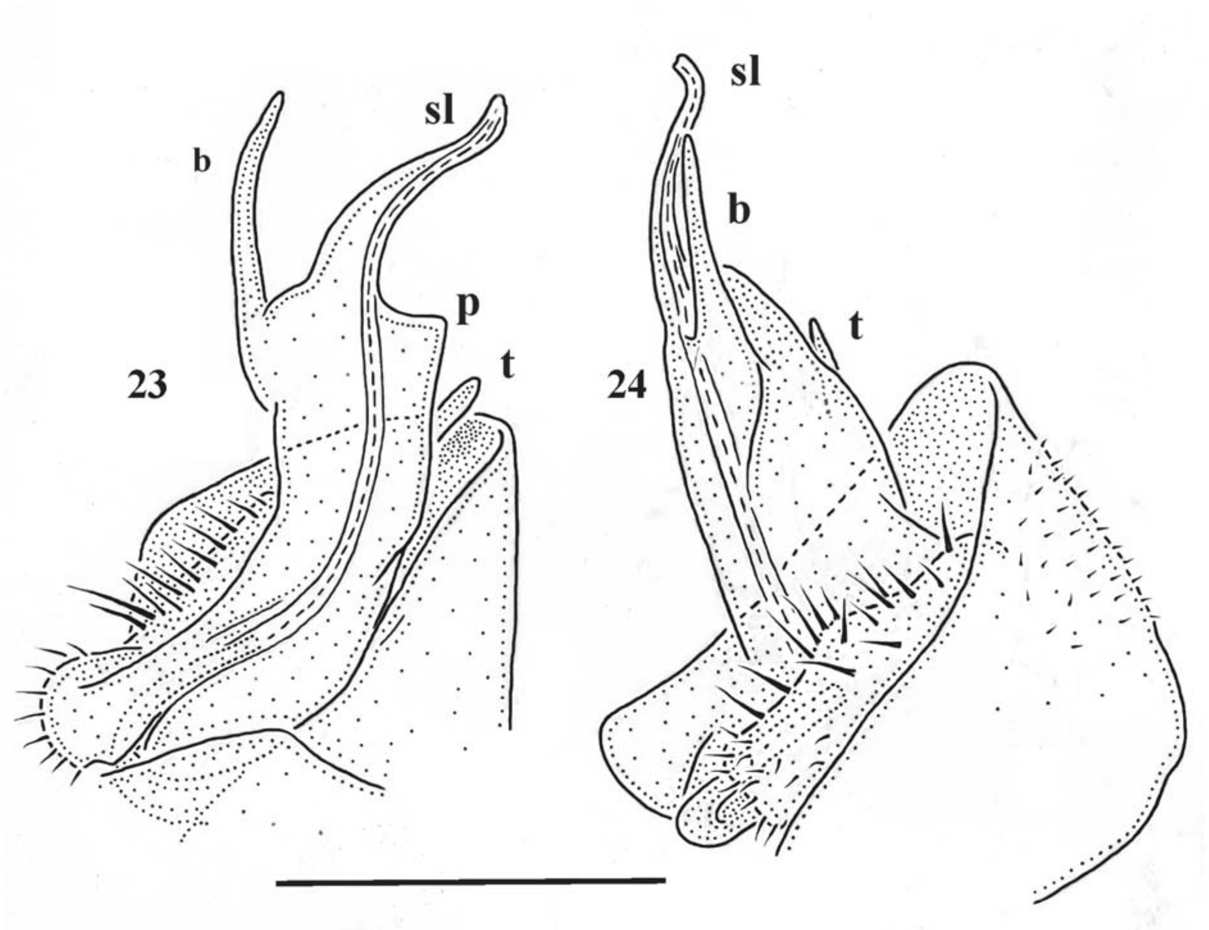


Figs 17–22. *Evurodesmus proximus* sp.n., ♂ paratype, gonopods, ventral (17), ventral (1eft gonopod, 18), ventrocaudal (right gonopod, 19), same, enlarged (20), mesal view (21) and lateral view (22). Scale bars: 0.05 (19 & 22) and 0.02 mm (20 & 21); 17 and 18 not to scale.

Рис. 17–22. *Evurodesmus proximus* sp.n., паратип ♂, гоноподы, снизу (17), снизу (левый гонопод, 18), снизу и сзади (правый гонопод, 19), то же, увеличено (20), изнутри (21) и сбоку (22). Масштаб: 0,05 (19 и 22) и 0,02 мм (20 и 21); 17 и 18 без масштаба.

lobulation and a very distinct porostele instead of caudal lobulation on pore-bearing segments; both caudal and front margins of paraterga distinctly lobulate. Ozopore formula: 5, 7, 9, 12, 15, all pores borne on porosteles (Figs 2, 5, 8, 12 & 16). Limbus microcrenulate, each crenulation extremely finely denticulate/fringed (Figs 13 & 14). Metatergal tubercles and crenulations beset with microvilli, setae absent. Epiproct invisible from above, hidden under caudal lobulations of 19th (♂) or 20th (♀) segment, with four strong setae on top (Figs 3, 6 & 9). Hypoproct subtrapeziform, caudal edge with two strong and well-separated setae and a depression in-between (Fig. 9), this depression beset with minute setae. Sterna very narrow, coxae nearly contiguous (Figs 8 & 9). Legs equally short and slightly enlarged in both sexes, tarsi longest. Epigynal ridge behind ♀ legs 2 low and inconspicuous.

Gonopods (Figs 17–24) taking up nearly entire surface of metazonum 7, almost reaching bases of paraterga. Coxae voluminous, microsetose on lateral face,



Figs 23 & 24. *Evurodesmus proximus* sp.n., ♂ holotype, right gonopod (21, mesal view) and left gonopod (22, lateral view). Scale bar: 0.1 mm.

Рис. 23 и 24. *Evurodesmus proximus* sp.n., голотип ♂, правый гоноподм (21, изнутри) и левый гоноподм (22, сбоку). Масштаб: 0,1 мм.

gonocoel very distinct. Telopodites elongated, rather simple, each carrying distally a long, slender, medial branch (**b**), a still longer solenomere (**sl**) with an angular prominence at base (**p**), and a small lateral tooth (**t**).

REMARKS. Being dark and lacking any troglomorphic features, this species seems to be troglophilic at most.

The genus *Evurodesmus* Silvestri, 1920 has hitherto been known as monotypic, with the sole species *E. biroi* Silvestri, 1920 described from Sattelberg, Morobe Province, Papua New Guinea [Silvestri, 1920]. *E. biroi* and *E. proximus* sp.n. are both very small (4–5 mm), show 5+5 lobulations at the front margin of the collum and, especially, share basically the same gonopod conformation: voluminous coxae containing a large gonocoel and 2-branched telopodites, one of the branches being a long and slender solenomere. However, *E. biroi* differs in 20, not 19, body segments in the male, as well as in a far more complete ozopore formula. Based on this evidence, *E. proximus* sp.n. seems to represent a simplified, obviously more advanced stage in the evolution of *Evurodesmus*: a reduced ozopore formula, a lesser number of body segments, more elaborate metatergal tuberculations and less complex gonopods.

In general, the classification of Pyrgodesmidae is in an absolutely chaotic condition [Hoffman, 1980], with the number of genera (169, of which 116 are monobasic) only modestly exceeding that of the constituent species (371) [Jorgensen & Sierwald, 2010]. Despite the above differences between *E. biroi* and *E. proximus* sp.n., which formerly would have inevitably led to the establishment of another new monotypic genus, we have no doubt to formally place our new species in *Evurodesmus*, because *E. proximus* is indeed especially similar to *E. biroi*. The new generic diagnosis would read as follows.

Evurodesmus Silvestri, 1920

Type species: *Evurodesmus biroi* Silvestri, 1920, by monotypy.

DIAGNOSIS. Small pyrgodesmids (4–5 mm long) with 19 (♂) or 20 (♂, ♀) body segments; a typical flabellate collum (covering head from above) showing

5+5 lobulations at front margin; differentiated metatergal tuberculations devoid of setae; strongly declined paraterga (mostly bilobate at lateral margin) with a number of lobulations both at front and caudal margins; ozopore formula at least 5, 7, 9, 12, 15, mostly borne on porosteles replacing caudolateral lobulations; epiproct invisible from above; gonopods relatively simple, telopodites deeply sunken into a gonocoel formed by voluminous coxae, rather slender, distally 2-branched, one of the branches being a long and slender solenomere.

Cryptodesmidae

Astrolabius hoffmani **sp.n.**
Figs 25–50.

Holotype: ♂ (NMNHS), **Papua New Guinea**: bottom of 150 m shaft near Girtoil (the sting), 8 August 1975, leg. B.S.E. (British Speleological Expedition) (Microprep. PS–1/2009). Paratypes: 1 ♀ (SEM, NMNHS), 1 ♀ (ZMUC), same locality, date and collector; 1 ♂ (ZMUM), 1 ♀ (SEM, NMNHS), **Western Province**, Bahrmann Mountains, 2,300 m a.s.l., Finim Tel Plateau, 19 August 1975, leg. B.S.E.; 1 ♀ (NMNHS), 1 juv. (SEM, NMNHS), Finim Tel area, 2,300 m a.s.l., rain forest, 8 August 1975, leg. P. Beron; Finim Tel area, 2,260 m a.s.l., 5 August – 11 September 1975, leg. B.S.E.; 1 ♂ (gonopods lost); 1 ♂, 2 ♀♀ (NMNHS), 1 ♂, 2 juv. (NMNHS), Bahrmann Mountains, 2,260–2,600 m a.s.l., south of Finim Tel Plateau, August 1975, leg. B.S.E.; ♂ (NMNHS), Finim Tel, rain forest, 2,300 m a.s.l., August 1975, leg. B.S.E. (Microprep. PS–3/2009); 1 juv., 1 fragm. juv. (NMNHS), Finim Tel Plateau, Cave Kumsop Tem, 16 August 1975, leg. B.S.E. (P. Beron & Ph. Chapman); 1 ♂, 1 ♀ (NMNHS), **West Sepik Province**, Telefomin area, 1,700 m a.s.l., September 1975, leg. P. Beron; 1 ♂ (Microprep. PS–4/2009, NMNHS), 1 ♂ (SEM, NMNHS), 1 ♀ (NMNHS), Telefomin area, 1,600 m a.s.l., 2 August 1975, leg. B.S.E. (P. Beron).

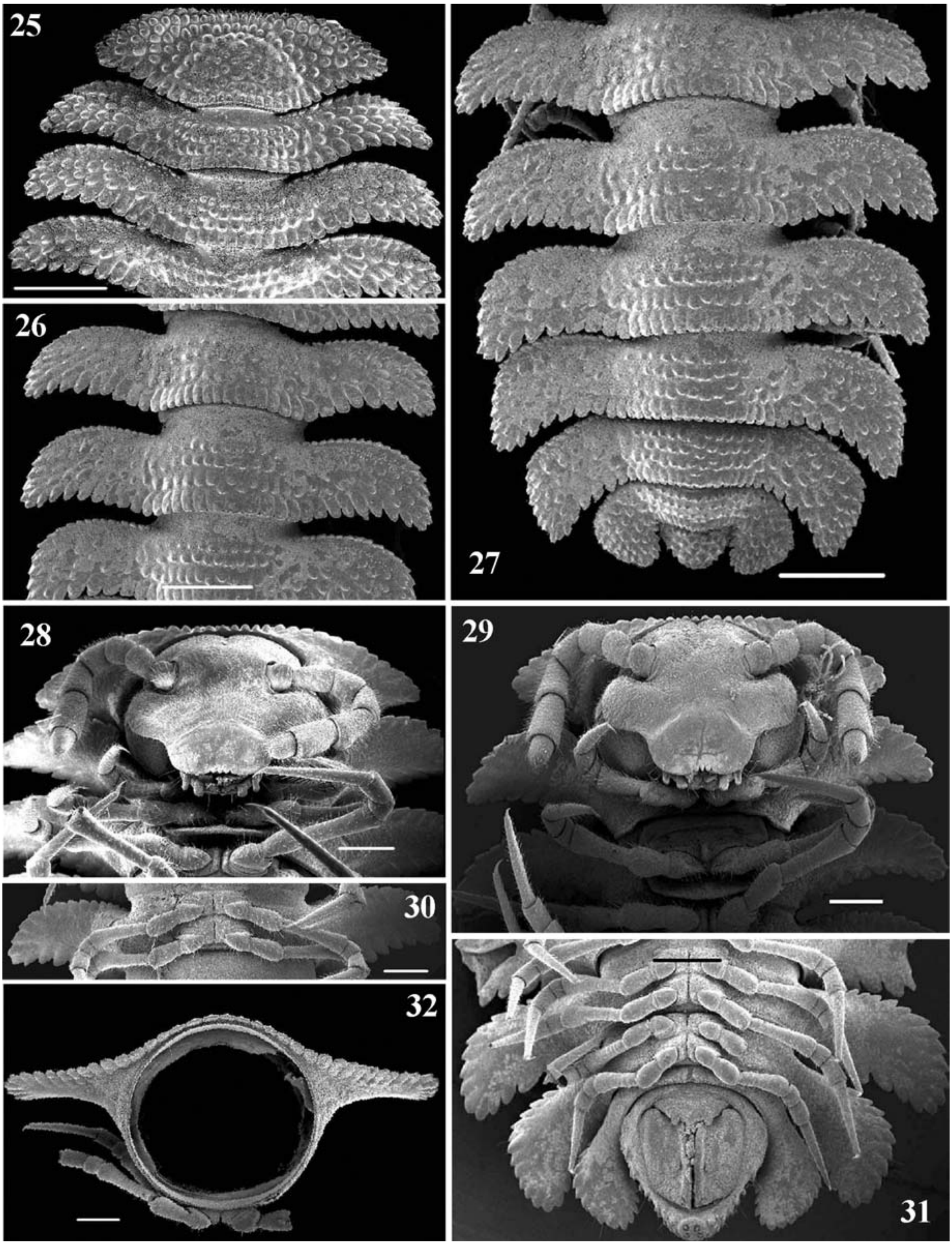
DIAGNOSIS. Differs from *A. dorsilobus* (Attems, 1914), the type, and only, species of *Astrolabius* Verhoeff, 1931, in the considerably larger adults (≥ 18 mm, versus 12.5 mm long), the lighter antennae (versus black-brown), medium-sized and typically setiform tergal trichome (versus very short and spiniform), and the gonopod parabasal process shorter (versus longer) than branch **b**.

NAME. Honours Richard L. Hoffman, the leading specialist in Diplopoda.

DESCRIPTION. Length 18–20 mm, width of pro- and metazona 1.7–1.9 and 4.2–6.0 mm, respectively (♂), or length up to ca 22 mm, width of pro- and metazona 2.0–2.2 and 6.0 mm, respectively (♀). Holotype ca 20 mm long, 1.5 and 4.2 wide on pro- and metazona, respectively. Coloration uniformly light grey-yellowish or light grey-brown to grey-brown, only vertigial region dark brown, sometimes median parts of metaterga and vertigial region of head slightly infuscate, dark brown; juveniles entirely pallid.

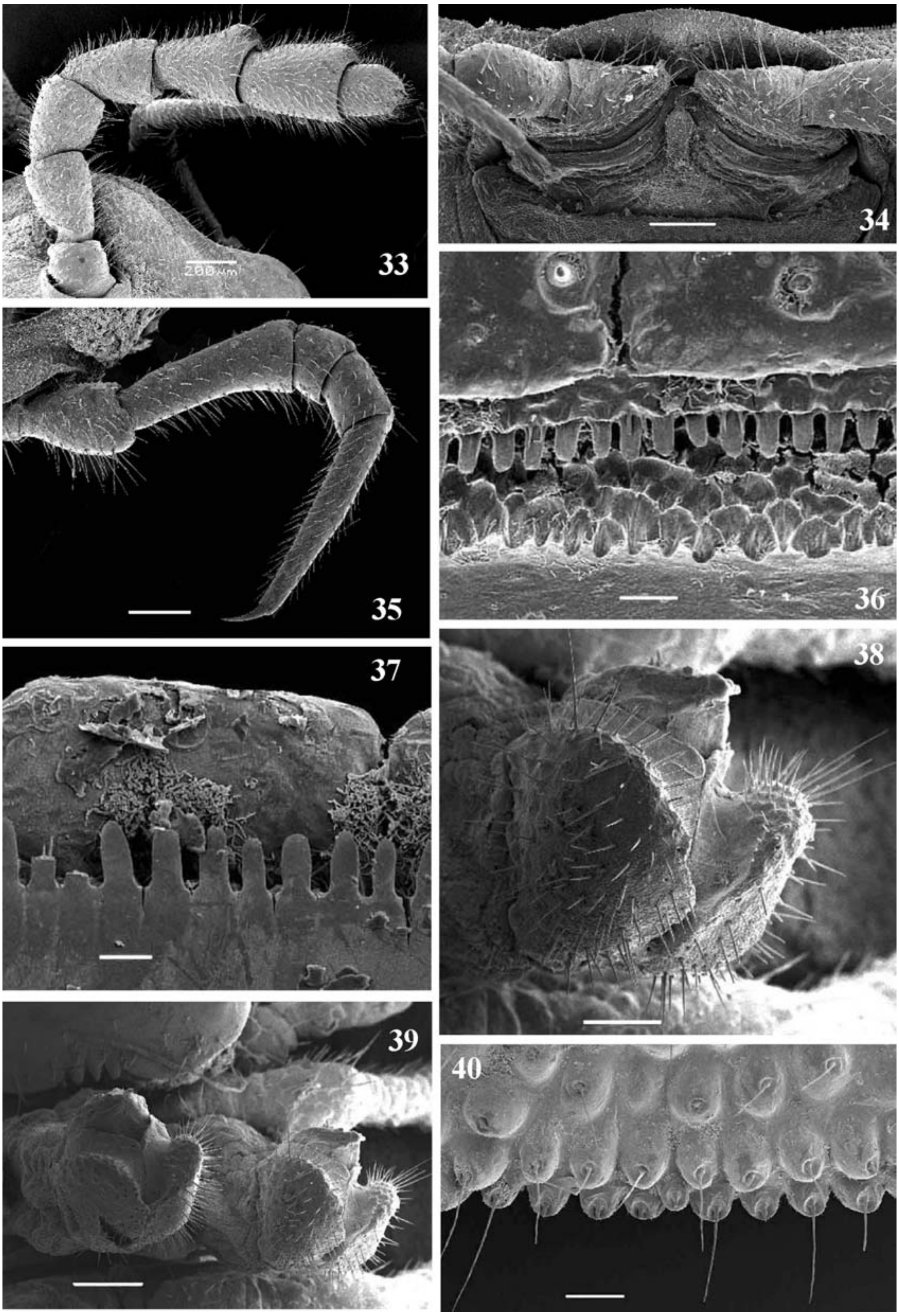
Body with 20 segments. In width, head << collum << segment 2 < 3=16, thereafter body rapidly tapering towards telson. Head slightly transverse (Figs 28 & 29), very densely pilose all over, interantennal isthmus ca twice as large as antenomere 1, vertigial region smooth. Antennae medium-sized (Fig. 33), clavate, reaching behind midway of segment 4 ventrally; epicranial suture shallow but evident. Antennomere 6 largest, both antennomeres 5 and 6 with a distodorsal tubercle supporting a tight group of bacilliform sensilla. Collum slightly convex medially (Figs 25, 28 & 29), with very large subhorizontal wing-shaped paraterga carrying four lobulations each at caudal margin, its front margin multituberculate and regularly invaginated; surface irregularly multituberculate, each tubercle and lobulation crowned with a medium-sized seta. Segments 2 (Fig. 25) and 3 each with ca 4–5 irregular transverse rows of similar tubercles, median parts convex and supplied with 5+5 distinct and contiguous crenulations caudally; paraterga subhorizontal, each with about three irregular rows of smaller tubercles and more distinct and better separated 8+8 crenulations at caudal edge (13 or 14 counting from midline); each tubercle and crenulation likewise crowned with a seta. Following metaterga (Figs 26 & 27) until 16th subequal, each midbody paratergum slightly shorter to a little longer than entire prozonum or middle part of metaterga (Fig. 32), with four, mostly regular, transverse rows of tubercles, these being evidently smaller in first 1–3 rows; paraterga subhorizontal, their caudal crenulations larger and better separated, each about 1.5–2.0 times as long as broad, both tubercles and crenulations crowned with a seta. Metaterga 17–19 (Figs 27 & 30) directed increasingly caudad and surpassing rear tergal contour, each already with 6–8 caudal crenulations and sometimes with 4–5 transverse rows of tubercles, sometimes even more regular and arranged in four rows on segment 17, less regular and arranged in five rows on segments 18 and 19. Paraterga 19 reaching caudally tip of a likewise multituberculate, setose, conical and rather broadly rounded epiproct. Ozopores missing. Tegument smooth and shining, tergal setae often broken off, but visible as evident insertion points (Fig. 40). Limbus (Figs 36 & 37) like individual linguiform lobules. Hypoproct (Fig. 31) subtrapeziform, caudal paramedian setae strongly separated and borne on evident knobs. Sterna narrow (Fig. 30), axial line deep; epigynal ridge higher than ♀ coxae 2, slightly convex (Fig. 29). Coxae 2 of ♂ (Fig. 34) with two evident, apicomedian, rounded, stout or slenderer, digitiform processes, each crowned with orifice of vas deferens. Legs (Fig. 35) long and slender, densely setose ventrally, femora and tarsi subequal in length; midbody legs ca twice as long as segment height. Vulvae (Figs 38 & 39) simple, tripartite due to subequally high, rounded, densely setose, lateral valves and a front operculum.

Gonopod aperture small, obcordate (Fig. 41). Gonopods (Figs 42–50) with subtriangular, poorly setose coxae, each coxa being supplied with a long, slender, unciform cannula retrorse at tip; telopodites slightly longer than coxites, each carrying a very long, slender, simple process **p** medioparabasally; seminal groove starting medially, turning laterad on a conspicuous, rather broad, distally subtruncate solenomere **sl**; latter subequal in length to shorter than both an anterior, smaller, membranous branch **b** and a large, rounded,



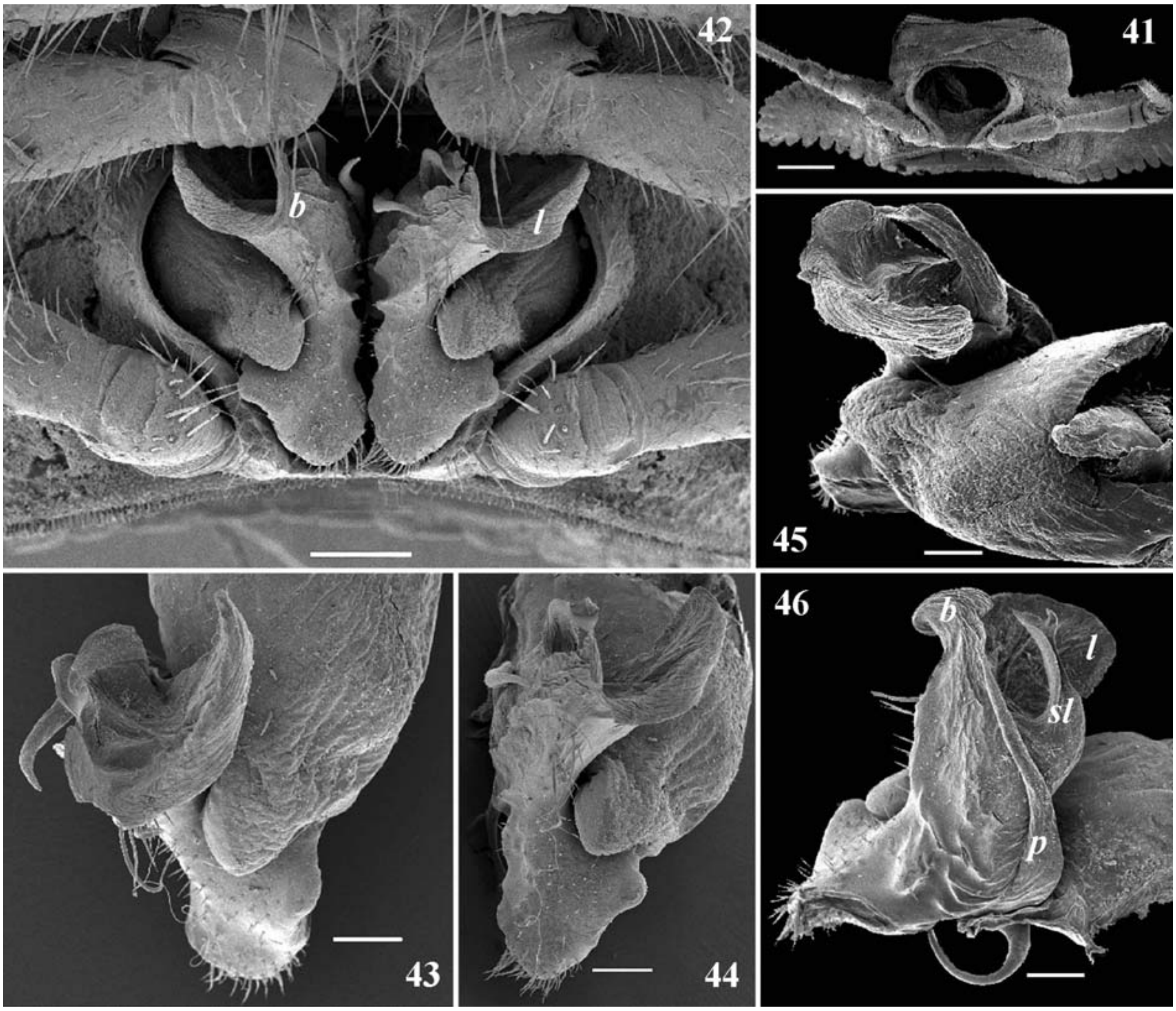
Figs 25–32. *Astrolabius hoffmani* sp.n., ♂ & ♀ paratypes: 25 — anterior part of body, dorsal view; 26 — middle part of body, dorsal view; 27 — posterior part of body, dorsal view; 28 & 29 — anterior part of body, ventral view; 30 — midbody segment, ventral view; 31 — posterior part of body, ventral view; 32 — cross-section of a midbody segment, posterior view. Scale bars: 1.0 (25–27) and 0.5 mm (28–32).

Рис. 25–32. *Astrolabius hoffmani* sp.n., паратипы ♂ и ♀: 25 — передняя часть тела, вид сверху; 26 — средняя часть тела, вид сверху; 27 — задняя часть тела, вид сверху; 28 & 29 — передняя часть тела, вид снизу; 30 — среднетуловищный сегмент, вид снизу; 31 — задняя часть тела, вид снизу; 32 — поперечный срез среднетуловищного сегмента, вид сзади. Масштаб: 1,0 (25–27) и 0,5 мм (28–32).



Figs 33–40. *Astrolabius hoffmani* sp.n., ♂ & ♀ paratypes: 33 — antenna, dorsomedial view; 34 — coxae 2, ventral view; 35 — midbody leg; 36 — limbus, dorsal view; 37 — same, enlarged, ventral view; 38 & 39 — vulvae, ventral view; 40 — metatergal tuberculations, enlarged. Scale bars: 0.2 (33–35 & 38), 0.1 (39 & 40), 0.02 (36) and 0.01 mm (37).

Рис. 33–40. *Astrolabius hoffmani* sp.n., паратипы ♂ и ♀: 33 — антенна, вид сверху и изнутри; 34 — тазики 2, вид снизу; 35 — среднетуловищная нога; 36 — лимбус, вид сверху; 37 — то же, увеличено, вид снизу; 38 и 39 — вульвы, вид снизу; 40 — метатергальные бугорки, увеличено. Масштаб: 0,2 (33–35 и 38), 0,1 (39 и 40), 0,02 (36) и 0,01 мм (37).



Figs 41–46. *Astrolabius hoffmani* sp.n., ♂ & ♀ paratypes: 41 — ♂ segment 7, ventral view; 42 — gonopods, ventral view; 43–45 — left gonopod, subventral, ventral and lateral views, respectively; 46 — right gonopod, mesal view. Scale bars: 0.5 (41), 0.2 (42) and 0.1 mm (43–46).

Рис. 41–46. *Astrolabius hoffmani* sp.n., паратипы ♂ и ♀: 41 — сегмент 7 у ♂, вид снизу; 42 — гоноподы, вид снизу; 43–45 — левый гоногод, соответственно почти снизу, снизу и сбоку; 46 — правый гонопод, вид изнутри. Масштаб: 0,5 (41), 0,2 (42) и 0,1 мм (43–46).

caudolateral lobe **l**; latter sometimes supplied with an apical tooth.

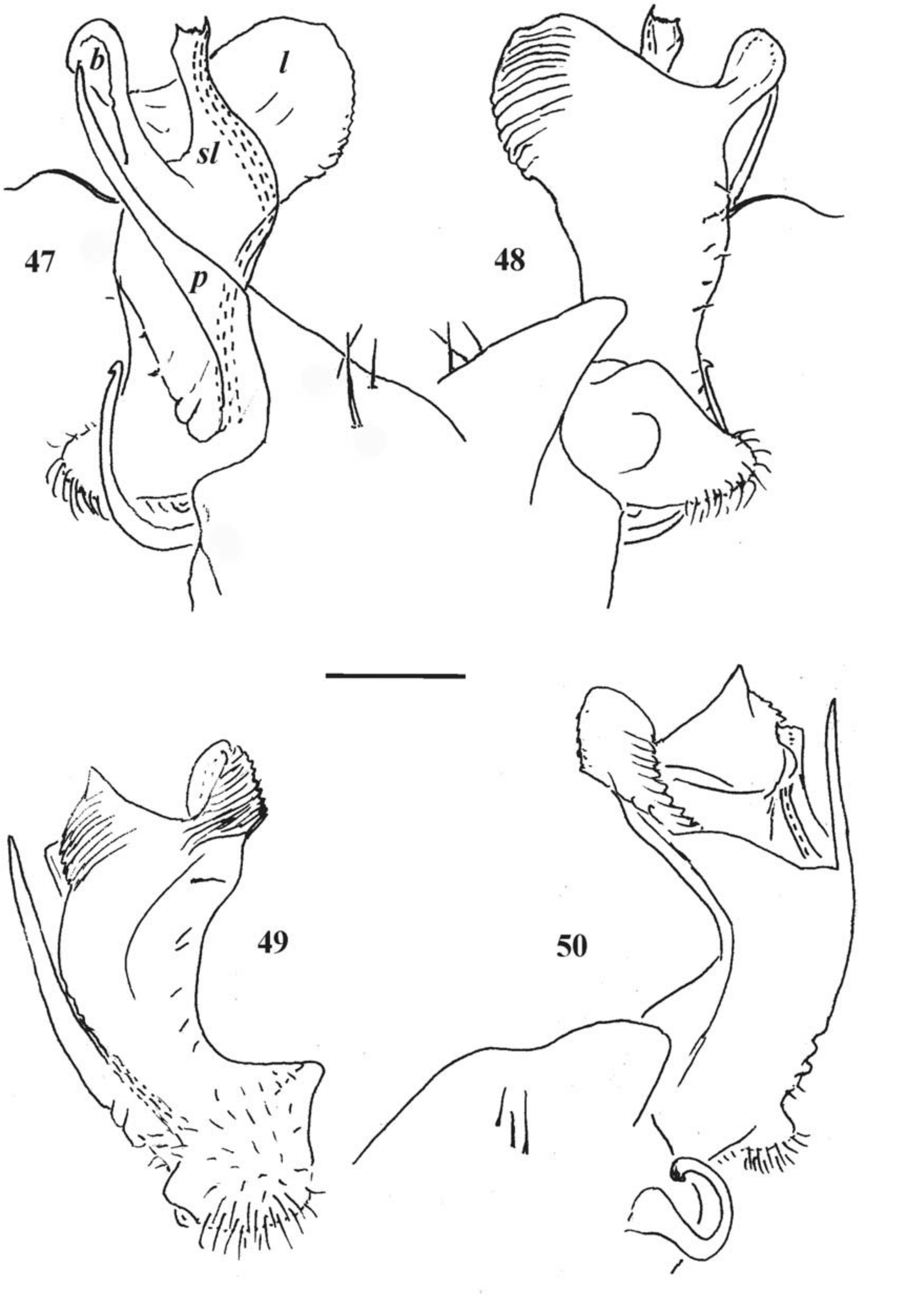
REMARKS. The genus *Austrolabius* Verhoeff, 1931 has hitherto been considered monobasic, with the type species *A. dorsilobus* (Attems, 1914) being the only cryptodesmid yet known from New Guinea. This genus was first proposed [Verhoeff, 1931] to accommodate *Aporodesminus dorsilobus* Attems, 1914, a species indeed so strongly different from the type species, *Aporodesminus wallacei* Silvestri, 1904, originally from the Hawaiis, that *A. dorsilobus* is currently assigned to Cryptodesmidae, whereas the pantropical, semiaquatic *A. wallacei* to Pyrgodesmidae [Adis et al., 1998].

Astrolabius is still a genus of uncertain tribal position within Otodesminae [Hoffman, 1973, 1980]. Since the division of this subfamily into tribes appears to be vulnerable [Golovatch et al., 2010], we prefer to maintain *Astrolabius* without tribal assignment, despite its presumed close resemblance to *Niponia* Verhoeff, 1931 which merits the status of a tribe of its own [Hoffman, 1973, 1980]. Furthermore, with the discovery of another congener, below we venture to re-diagnose this genus and suggest its possible close affinities.

Astrolabius Verhoeff, 1931

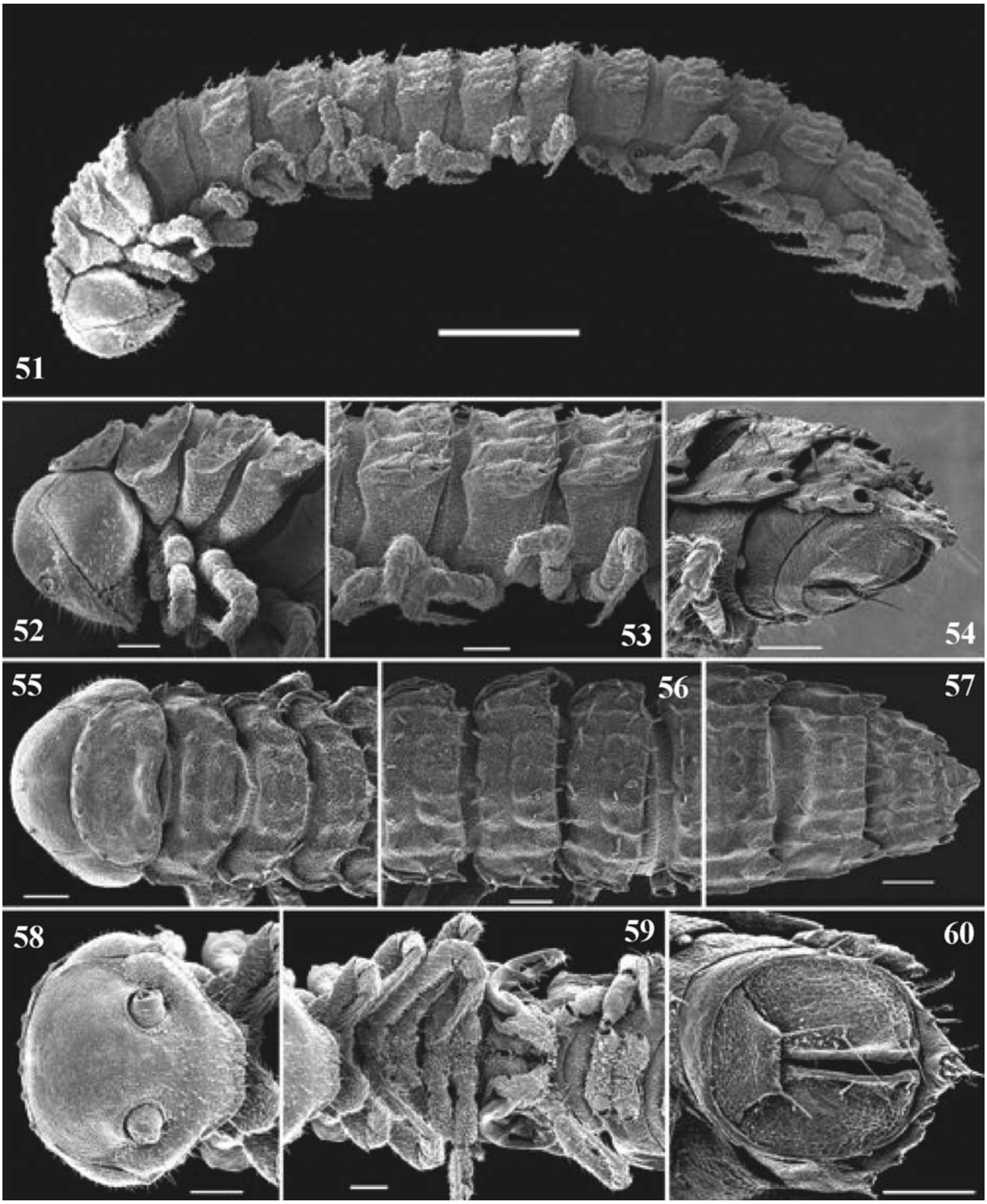
Type species: *Aporodesminus dorsilobus* Attems, 1914, by monotypy.

DIAGNOSIS. Medium- to large-sized Cryptodesmidae (12–22 mm) with 20 body segments; a flabellate collum covering head from above; antennomere 6 largest; very broad and subhorizontal paraterga crenulate both at front and caudal margins, as well as laterally; ozopores wanting; surface of metaterga densely tuber-



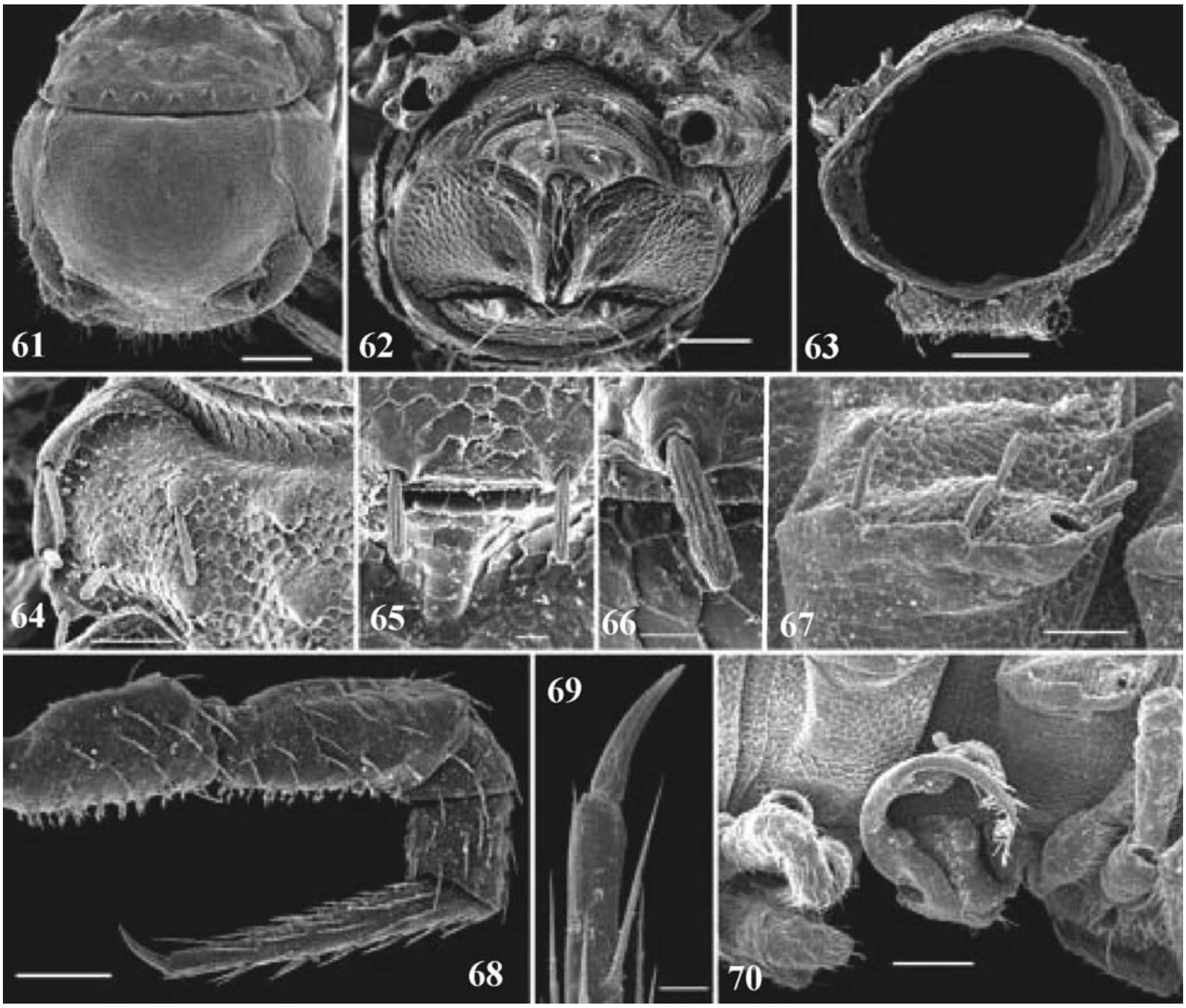
Figs 47–50. *Astrolabius hoffmani* sp.n., ♂ paratypes: 47 & 48 — right gonopod, mesal and lateral views, respectively; 49 & 50 — left gonopod, lateral and mesal views, respectively. Scale bar: 0.2 mm.

Рис. 47–50. *Astrolabius hoffmani* sp.n., паратипы ♂: 47 и 48 — правый гонопод, соответственно изнутри и сбоку; 49 и 50 — левый гонопод, соответственно сбоку и изнутри. Масштаб: 0,2 мм.



Figs 51–60. *Solaenaulus butteli* (Carl, 1922), ♂ from Lae: 51 — habitus, lateral view; 52, 55 & 58 — anterior part of body, lateral, dorsal and ventral views, respectively; 53, 56 & 59 — middle part of body, lateral, dorsal and ventral views, respectively; 54, 57 & 60 — posterior part of body, lateral, dorsal and ventral views, respectively. Scale bars: 0.5 (51), 0.1 (52–59) and 0.12 mm (60).

Рис. 51–60. *Solaenaulus butteli* (Carl, 1922), ♂ из Лаэ: 51 — габитус, вид сбоку; 52, 55 и 58 — передняя часть тела, соответственно сбоку, сверху и снизу; 53, 56 и 59 — средняя часть тела, соответственно сбоку, сверху и снизу; 54, 57 и 60 — задняя часть тела, соответственно сбоку, сверху и снизу. Масштаб: 0,5 (51), 0,1 (52–59) и 0,12 мм (60).



Figs 61–70. *Solaenaulus butteli* (Carl, 1922), ♂ from Lae: 61 — head and collum, frontodorsal view; 62 — telson, caudal view; 63 — cross-section of a midbody segment, caudal view; 64 & 67 — left midbody paratergum, dorsal and lateral views, respectively; 65 & 66 — metatergal setae, enlarged; 68 — leg 3, lateral view; 69 — claw, lateral view; 70 — left gonopod in situ, lateral view. Scale bars: 0.1 (61, 63 & 70), 0.05 (62, 64, 67, 68), 0.02 (65) and 0.01 mm (66, 69).

Рис. 61–70. *Solaenaulus butteli* (Carl, 1922), ♂ из Лаэ: 61 — голова и коллум, вид спереди и сверху; 62 — тельсон, вид сзади; 63 — поперечный срез через среднетуловищный сегмент, вид сзади; 64 и 67 — левый среднетуловищный паратергит, соответственно сверху и сбоку; 65 и 66 — метатергальные щетинки, увеличено; 68 — нога 3, вид сбоку: 69 — коготок, вид сбоку; 70 — левый гонопод in situ, вид сбоку. Масштаб: 0,1 (61, 63 и 70), 0,05 (62, 64, 67, 68), 0,02 (65) и 0,01 мм (66, 69).

culate and setose, setae being short to medium sized; gonopod coxites poorly setose, each telopodite with a conspicuous, long and slender parabasal branch medially and a 3-partite distal part, medial branch being a rather short and stout solenomere.

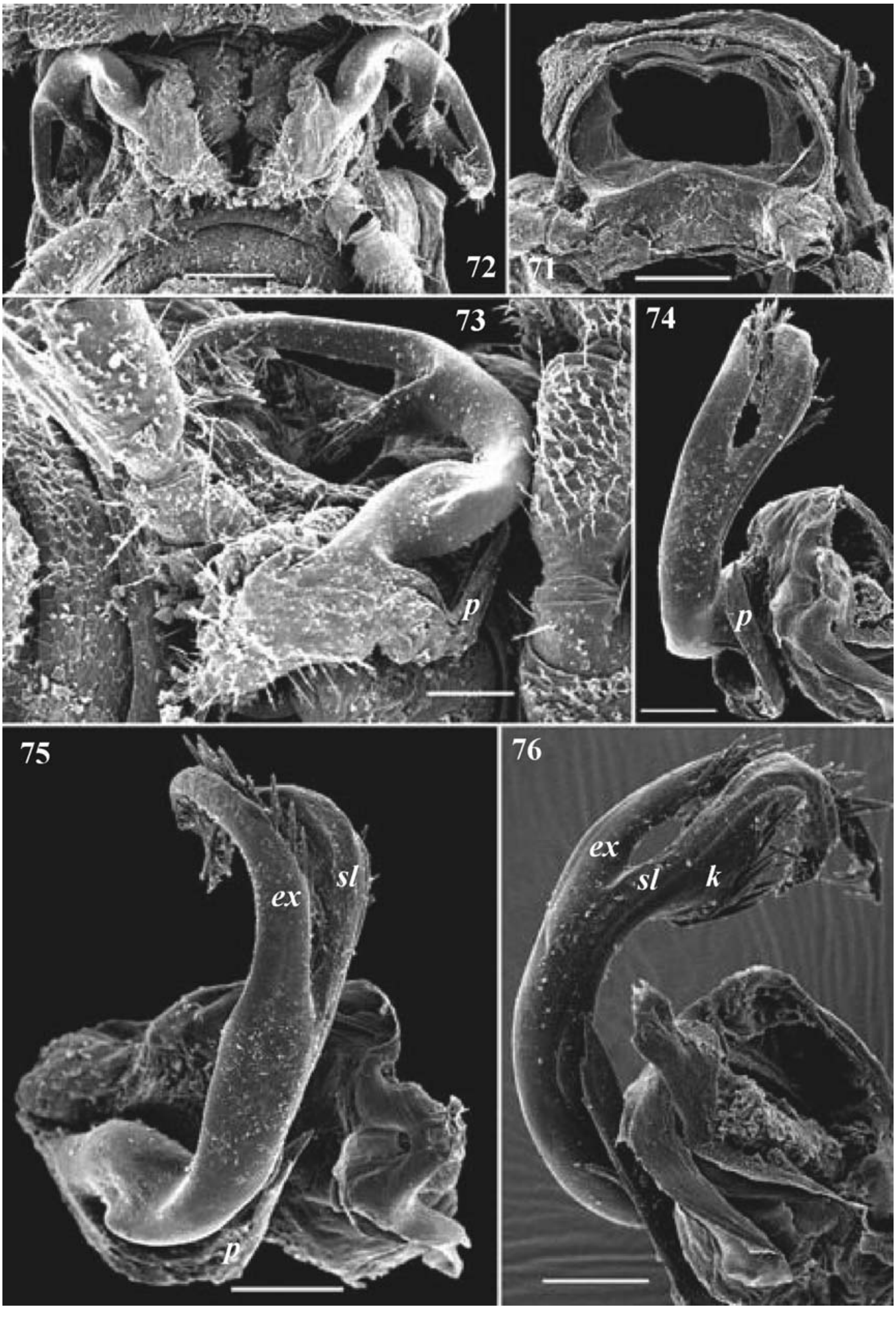
Because *Niponia* Verhoeff, 1931, with *N. nodulosa* Verhoeff, 1931 as the type, and only, species, which currently is known from Japan, Taiwan and continental China, is the sole genus in Otodesminae which shares with *Astrolabius* the broad and tuberculate/crenulate paraterga, a distinct tergal trichome and the absence of ozopores, coupled with relatively stout and complex gonopods, we believe in their especially close affinities. However, *Astrolabius* differs from *Niponia* in the presence of a conspicuous, long and slender parabasal process (**p**) medially (versus its absence) and a 3-branched distal part of the gonotelopodite, the medial branch being a rather short, stout but very evident solenomere (**sl**) (versus probably a bipartite distal part and an inconspicuous solenomere).

Opisotretidae

Solaenaulus butteli (Carl, 1922)
Figs 51–81.

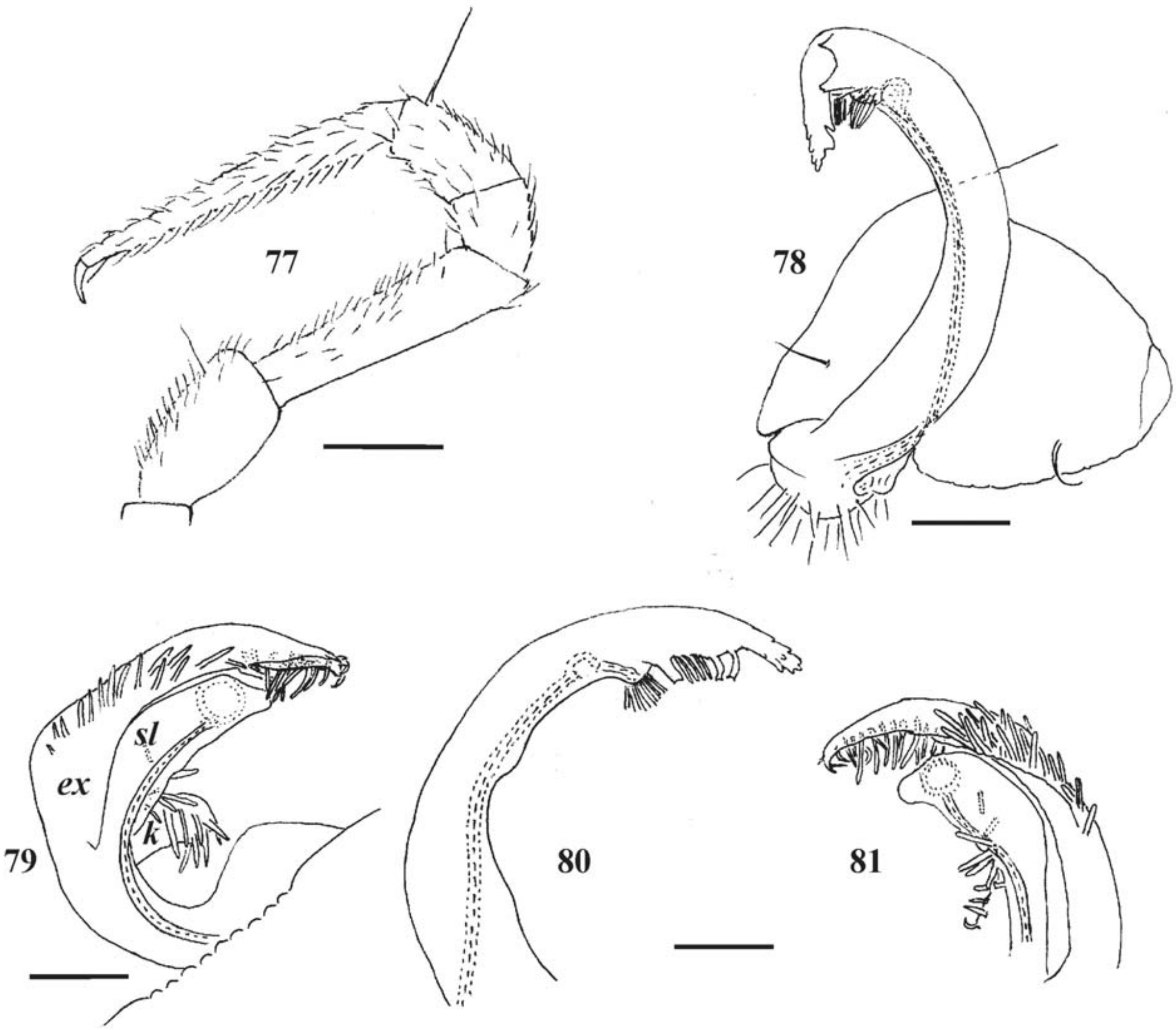
MATERIAL. 3 ♂♂, 1 ♀ (NMNHS), Papua New Guinea: Lae, ca 10 m alt., 10.XI.1975, leg. P. Beron (1 ♂ – SEM, 1 ♂ – Microprep. P.S.–6/2009).

REDESCRIPTION. Length 5.5 (♂) or 6.0 (♀) mm, width of pro- and metazona 0.5 and 0.7 (♂) mm, or 0.55 and 0.75 (♀) mm, respectively. Coloration light



Figs 71–76. *Solaenaulus butteli* (Carl, 1922), ♂ from Lae: 71 — segment 7, ventral view; 72 — gonopods, ventral view; 73–76 — left gonopod, ventrolateral, subfront, frontodorsal and mesal views, respectively. Scale bars: 0.05 (71, 73–76) and 0.01 mm (72).

Рис. 71–76. *Solaenaulus butteli* (Carl, 1922), ♂ из Лаэ: 71 — сегмент 7, вид снизу; 72 — гоноподы, вид снизу; 73–76 –левый гонопод, соответственно снизу и сбоку, почти спереди, спереди и сверху и изнутри. Масштаб: 0,05 (71, 73–76) и 0,01 мм (72).



Figs 77–81. *Solaenaulus butteli* (Carl, 1922), ♂ from Lae: 77 — leg 9, lateral view; 78–81 — gonopods, dorsolateral, lateral, mesal and submesal views, respectively. Scale bars: 0.4 (78 & 79), 0.2 (77) and 0.1 mm (80 & 81).

Рис. 77–81. *Solaenaulus butteli* (Carl, 1922), ♂ из Лаэ: 77 — нога 9, вид сбоку; 78–81 — гоноподы, соответственно сверху и сбоку, сбоку, изнутри и почти изнутри. Масштаб: 0,4 (78 и 79), 0,2 (77) и 0,1 мм (80 и 81).

marbled grey to pallid; only dorsal half of body a little infuscate.

Body with 19 (♂) (Fig. 59) or 20 (♀) segments, tegument dull. Antennae long and clavate, reaching beyond segment 4 dorsally; antennomeres 2–5 elongate, only slightly broadened distally, antennomere 6 contrastingly strongly enlarged, with an abrupt geniculation with antennomere 5, nearly as high as long and about as long as antennomere 5; antennomere 6 with a distodorsal group of bacilliform sensilla, a smaller group in same position on antennomere 5; antennomere 7 with a minute dorsoparabasal knob. Head densely setose in clypeolabral region, very poorly so on vertex; ♂ head without modifications, epicranial suture evident. In width, head = segments 5–16 >> collum > 2 > 3=4 (♂), or head = segments 5–17 >> collum > 2–4 (♀), thereafter body gradually tapering towards telson. Paraterga small but evident (Figs 51–60, 64 & 67), lying at about 1/3 to 1/4 of metazonital height, subhorizontal to slightly declivous, starting from segment 2 medium-sized, with 2–3 incisions at lateral margin (in front of ozopores on poriferous segments). Tergal trichome (Figs 65–67) bacilliform, dense, short, borne on oblong metatergal bosses (as usual, arranged in three transverse rows) and lateral incisions, each seta being ribbed longitudinally. Ozopore formula normal (Fig. 51), pores lying near caudolateral corner of paraterga, opening dorsolaterally until segment 16 (♂) (Fig. 54) or 17 (♀), onward dorsocaudally. Caudal corner of paraterga (Fig. 51) lying within rear tergal contour until segment 12, thereafter increasingly well protruding behind. Pleurosternal carinae absent. Legs long and slender (Figs 68 & 77), ca 1.6–1.7 times as long as midbody height, only slightly enlarged in ♂; ♂ sterna,

coxae, prefemora and femora in front of gonopods (Fig. 68) beset with particular, bifid setae ventrally; trichome of ♂ telopodites mostly microserrate, tibiae and tarsi with sphaerotrichomes ventrally. Postgonopodal legs with usual trichome (Fig. 77). Claws long, slender, slightly curved (Fig. 69). Sterna densely setose, without modifications. Epiproct (Figs 51, 54, 57, 60 & 62) subconical, short. Hypoproct (Fig. 60) subtrapeziform, caudal setae on small knobs strongly separated. Epigynal ridge behind ♀ coxae 2 very low and inconspicuous.

Gonopod aperture (Fig. 71) broad, kidney-shaped. Gonopods (Figs 72–76, 78–81) with subglobose, poorly setose coxae. Each telopodite with a conspicuous caudal parabasal process on prefemur (**p**); both telopodites directed transversely dorsolaterally, distinctly biramous and beset with numerous bacilli in distal half, one of the branches being a longer, attenuate and strongly bacilliferous exomere (**ex**), the other a slightly shorter and distad stouter solenomere (**sl**) with an evident accessory seminal chamber devoid of a pulvillus, as well as with a similarly bacilliferous and subtriangular expansion (**k**) at base.

REMARKS. The genus *Solaenaulus* Attems, 1940 has hitherto been known to be represented by the type species *Opisotretus butteli* Carl, 1922, from Sumatra, as well as by the subspecies *S. butteli birmanica* [recte: -*cus*] Carl, 1941, from Myanmar (formerly Burma) [Carl, 1922, 1941]. The above discovery of *S. butteli* so far away from Sumatra is quite surprising, also representing the first formal record of this species in New Guinea.

When describing his *S. butteli birmanicus*, Carl [1941] noted a number of differences from the type subspecies, such as the somewhat better developed lateral incisions on the paraterga, the longer gonoprefemoral process (**p**) and the seti- rather than bacilliform ornamentations on the gonopod telopodite in the Burmese taxon. To our mind, these differences seem to be strong enough to treat *S. birmanicus* as a full species, stat.n. In contrast, the above sample from Papua New Guinea appears to show no such evident distinctions. Based on the original description of *S. butteli*, the only differences from the Sumatran population to note are the presence in our material of slightly better developed lateral incisions on the paraterga (more like in *S. birmanicus*), as well as of the bacilliform ornamentations on the gonopods extending somewhat more basad onto the exomere (**ex**).

ACKNOWLEDGEMENTS. We are most grateful to the Bulgarian-Russian and Russian-Bulgarian interacademician exchange programmes through which the present project has been funded. Special thanks go to Petar Beron (NMNHS) who has made his invaluable collections available for study and has always encouraged our cooperation.

References

Adis J., Golovatch S.I., Hoffman R.L., Hales D.F., Burrows F.J. 1998. Morphological adaptations of the semiaquatic millipede *Aporodesminus wallacei* Silvestri 1904 with notes on the taxonomy, distribution, habitats and ecology of this and a related species (Pyrgodesmidae Polydesmida Diplopoda) // Trop. Zool. Vol.11. P.371–387.

Attems C.G. 1914. Die indo-australischen Myriopoden // Arch. Naturg. Jg.80A. H.4. S.1–398.

Carl J. 1922. Wissenschaftliche Ergebnisse einer Forschungsreise nach Ostindien, ausgefuhrt im Auftrage der Akademie der Wissenschaften zu Berlin von H. v. Buttel-Reepen. VIII Diplopoden aus Sumatra, Java, Malakka und Ceylon. Gesammelt von Herrn Prof. Dr. v. Buttel-Reepen in den Jahren 1911–1912 // Zool. Jahrb., Syst. Bd.44. S.565–578.

Carl J. 1941. Orientalische Polydesmoiden // Rev. suisse Zool. T.48. No.6. P.359–376.

Golovatch S.I., Stoev P. 2009. New or poorly-known millipedes (Diplopoda) from Papua New Guinea, 1 // Arthropoda Selecta. Vol. 18. Nos 3–4. P.125–130.

Golovatch S.I., Geoffroy J.-J., Mauriès J.-P., VandenSpiegel D. 2010. Two new species of the millipede genus *Trichopeltis* Pocock, 1894 (Diplopoda: Polydesmida: Cryptodesmidae) from Vietnam and China // Arthropoda Selecta. Vol.19. No.2. P.63–72.

Hoffman R.L. 1973. A new milliped of the genus *Chonodesmus*, with a proposed reclassification of the family Cryptodesmidae (Diplopoda, Polydesmida) // Stud. Neotrop. Fauna. Vol.8. P.179–193.

Hoffman R.L. 1980 (for 1979). Classification of the Diplopoda. Genève: Muséum d'histoire naturelle. 237 p.

Jorgensen M.C., Sierwald P. 2010. Review of the Caribbean pyrgodesmid genus *Docodesmus* Cook with notes on potentially related genera (Diplopoda, Polydesmida, Pyrgodesmidae) // Int. J. Myriapodol. Vol.3. No.1. P.25–50.

Silvestri F. 1920. Descriptions of some Oriental Diplopoda Polydesmoidea of the subfamily Pyrgodesminae // Rec. Indian Mus. Vol.19. P.117–135.

Verhoeff K.W. 1931. Chilognathen aus den Bergamasker Alpen und Nachbargebieten; auch über zwei neue Gattungen der Polydesmoidea aus Spanien und Japan // Zool. Jahrb., Syst. Bd.61. S.397–522.